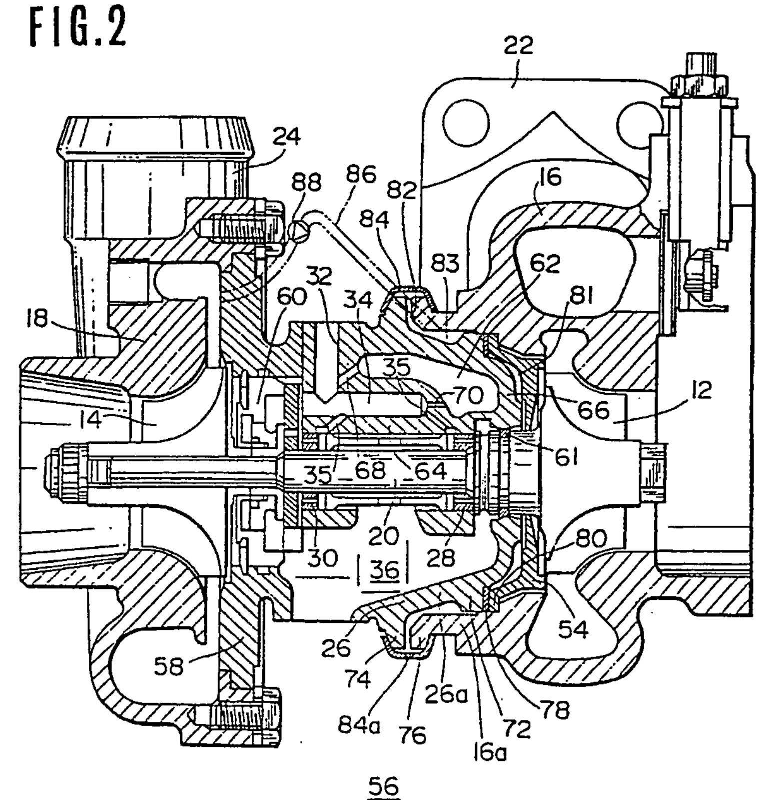
(12) UK Patent Application (19) GB (11) 2 126 663 A

(21) Application No 8314223
(22) Date of filing 23 May 1983
(30) Priority data
(31) 57/148851
(32) 27 Aug 1982
(33) Japan (JP)
(43) Application published
28 Mar 1984
(51) INT CL³
F04D 29/42 29/04 29/58
(52) Domestic classification
F1T B1H1 B2C
(56) Documents cited
None
(58) Field of search
F1T
F1G
(71) Applicant
Nissan Motor Company Limited
(Japan),
No 2 Takara-cho,
Kanagawa-ku, Yokohama City, Japan
(72) Inventor
Fumio Nishiguchi
(74) Agent and/or Address for Service
Marks & Clerk,
57 & 58 Lincolns Inn Fields, London WC2A 3LS

# (54) Turbocharger casing arrangement

(57) Axially spaced first and second flanges 72, 74 are formed on a domed portion 66 of the bell-shaped center casing 26. The turbine wheel casing 16 has an enlarged tapered mouth portion 16a which axially extends from the major portion of the casing and terminates at its leading end where a third flange 76 is formed. A stepped portion 8 is formed on the tapered inner surface of the mouth portion 16a. The domed portion of the center casing 26 is coaxially disposed in the mouth portion 16a of the turbine wheel casing 16 in such a manner that only the first flange 72 is seated via a heat insulator 78 on the stepped portion 80 to define certain clearances 81, 82 between the domed portion 66 and the mouth portion 16a. A V-band 84 is tightly mounted on the second and third flanges 74, 76 for coupling these flanges in a fixed spaced relationship. The first flange 72 is positioned closer to the highly heated portion of the turbine wheel casing 16 than the second flange 74.

FIG.2




GB 2 126 663 A

# FIG.1
(PRIOR ART)

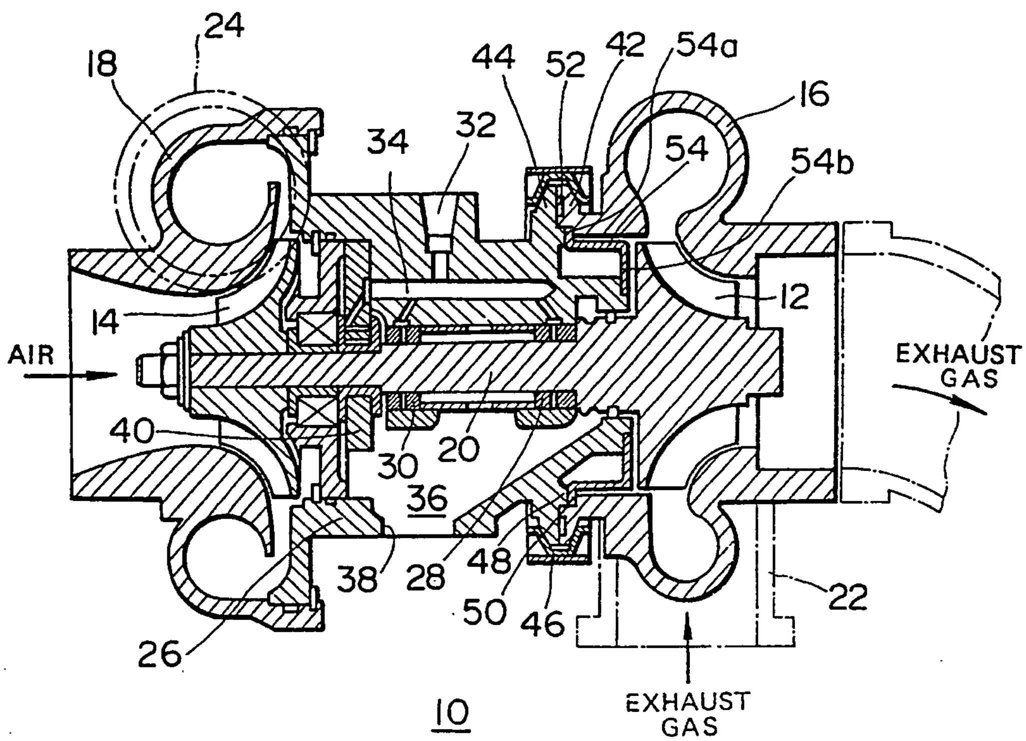
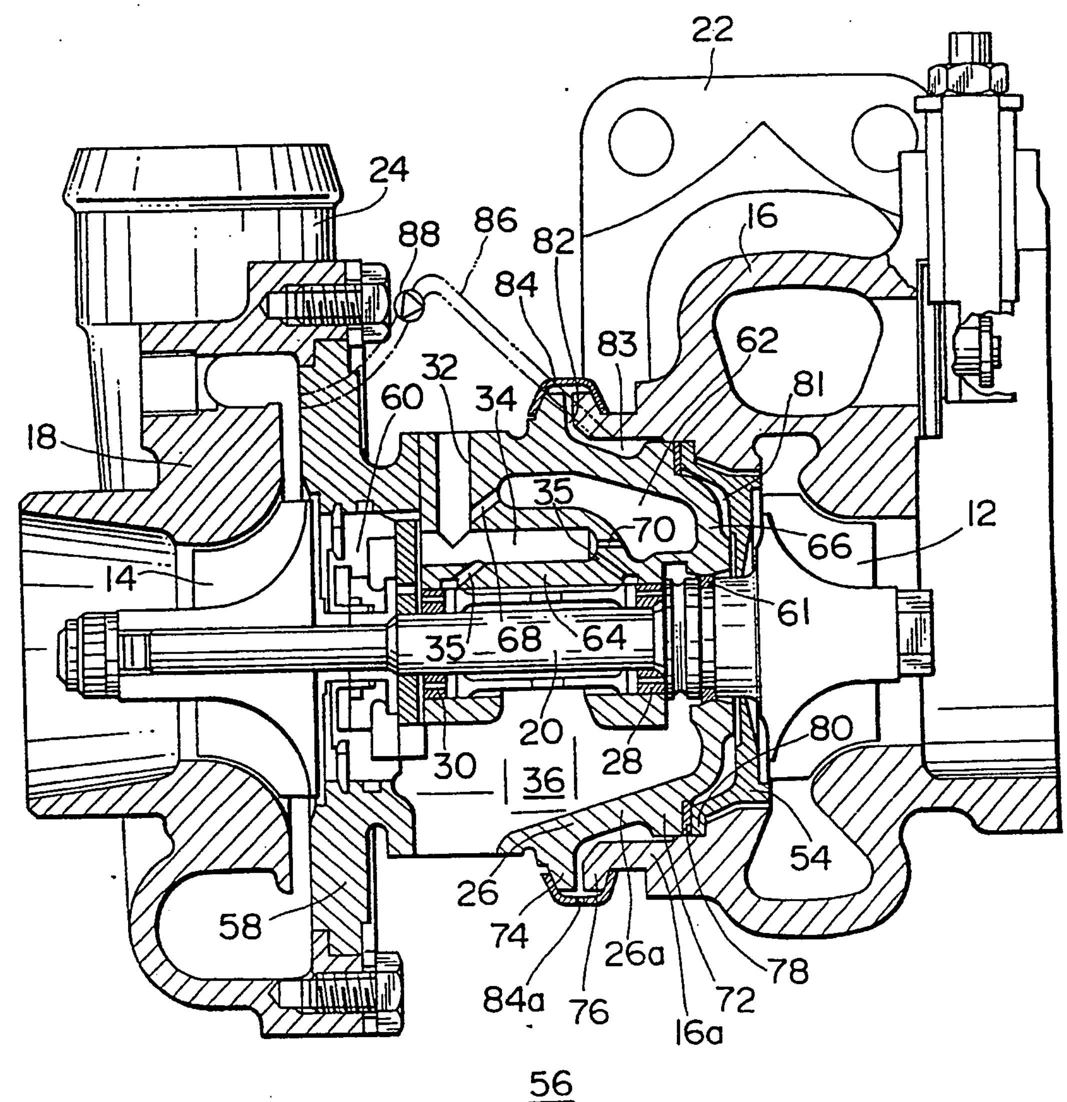


FIG.2


22
24
88
86
82
84
16
83
62
32
60
34
81
18
35
70
12
66
14
61
35
68
64
20
80
30
36
28
54
26
58
74
26a
78
84a
76
72
16a
56

## SPECIFICATION
## A turbocharger

The present invention relates in general to a turbocharger which supercharges the intake air by the force of the exhaust gas, and more particularly to an arrangement for preventing the interior of the center casing of the turbocharger from being severely heated.

In turbochargers, the bearings of the turbo-shaft are supplied with a large amount of cooling and lubricant oil to withstand the high speed rotation of the shaft. Nevertheless, some of the turbochargers still have a weak point in effectively cooling the bearings because of the remarkable heat transmission to the bearings from the highly heated turbine wheel casing. In these turbochargers, there arises a high possibility of damaging the bearings. Besides, this phenomenon decreases the lifetime of the lubricant oil. One of such conventional turbochargers will be outlined hereinafter in order to clarify the above-stated thermal weak point.

According to the present invention, there is provided a turbocharger which is constructed to minimize the heat transmission from the turbine wheel casing to the center casing.

Accoring to the present invention, there is provided a turbocharger which comprises a turbine wheel casing having a highly heated portion, a compressor wheel casing, a center casing disposed between the turbine wheel casing and the compressor wheel casing and supporting by means of bearings a turbo-shaft which carries a turbine wheel and a compressor wheel which are respectively housed in the turbine wheel casing and the compressor wheel casing, first means for seating only a first given portion of the center casing on a second given portion of the turbine wheel casing in a manner to define between the turbine wheel casing and the center casing a considerable clearance, a heat insulating material intimately disposed between the first given portion and the second given portion, second means for securing the turbine wheel casing and said center casing while keeping the clearance therebetween, the first means being located closer to the highly heated portion of the turbine wheel casing than the second means, and third means for defining an enlarged continuous chamber between the first and second means, the chamber being merged with the clearance.

Other objects and advantages of the present invention will become apparent from the following description when taken in conjunction with the accompanying drawings, in which:

Fig. 1 is an axially sectioned view of a conventional turbocharger having a weak point which can be solved by the present invention; and

Fig. 2 is an axially sectioned view of an improved turbocharger according to the present invention.

Prior to describing the invention, a conventional turbocharger will be outlined with reference to Fig. 1 in order to clarify the invention.

Referring to Fig. 1, there is shown the conventional turbocharger 10. The turbocharger 10 comprises generally a turbine wheel 12 and a compressor wheel 14 which are separately encased in a turbine wheel casing 16 and a compressor wheel casing 18. The two wheels 12 and 14 are mounted on and rotate with a common turboshaft 20. The turbine wheel 12 in this example is integral with the shaft 20. The turbine side of the turbocharger 10 mounts to the exhaust manifold outlet flange 22, and the compressor wheel side connects with the air intake manifold 24. A center casing 26 is sealingly disposed between the turbine wheel casing 16 and the compressor wheel casing 18. The turbo-shaft 20 is rotatably supported in the center casing 26 by means of floating bearings 28 and 30. The center casing 26 is formed with a lubricant oil inlet 32 and an oil passage 34 through which a suitable amount of cooling and lubricant oil is supplied to the foating bearings 28 and 30 for their cooling and lubrication. The oil from the bearings 28 and 30 is led to an oil chamber 36 of the center casing 26 and then discharged therefrom through an oil outlet 38 for its recirculation. Designated by numeral 40 is a thrust bearing which suppresses the axial displacement of the turbo-shaft 20 relative to the casings 16, 18 and 26. As is understood from the drawing, the turbine wheel casing 16 and the center casing 26 are respectively formed at their mutually facing portions with radially outwardly extending flanges 42 and 44 each having a tapered annular ridge. A V-band 46 is tightly mounted on the mated flanges 42 and 44 to couple these two casings 16 and 26. To assure tight coupling of them, an axially projected annular ridge 48 formed on the flange 44 is fitted in an annular stepped portion 50 formed in the other flange 42.

In the illustrated conventional turbocharger 10, the following heat blocking measures are employed between the turbine wheel casing 16 and the center casing 26.

As is seen from the drawing, the flange 42 of the turbine wheel casing 16 is formed with an annular groove 52 which defines an annular clearance between the mated flanges 42 and 44. The clearance 52 acts as a so-called heat blocking space. The provision of the clearance 52 reduces the practical contacting portions between the mated flanges 42 and 44. In addition to this measure, a flanged cylindrical heat insulating cylindrical member 54 is employed for the heat blocking. The outward flange portion 54a of the member 54 is intimately held between the ridge 48 of the center casing 26 and the stepped portion 50 of the turbine wheel casing 16, and the inward flange portion 54b of the same extends toward the turbo-shaft 20 and rests on the rightmost projected end of the center casing 26.

However, even when the turbocharger 10 is provided with the above-mentioned heat blocking measures, there still arises a fear of over-heating of the center casing 26 which may cause a thermal deterioriation of oil and breakage of the

bearings 28 and 30. In fact, just after stopping the operation of the turbocharger 10, the temperature in the center casing 26 rises greatly because in such a condition, the flow of the cooling (and lubricant) oil stops.

Applicant has revealed that the connecting manner between the turbine wheel casing 16 and the center casing 26 promotes the great temperature rise of the center casing 16 and thus the bearings 28 and 30, particularly the bearing 28. In fact, in the conventional connecting manner as described hereinabove, a so-called "major heat transmitting path" from the severely heated turbine wheel casing 16 to the bearing 28 is the shortest path in the solid section of the center casing 26 which extends from the practically contacting portions between the mated flanges 42 and 44 to the bearing 28. However, as is understood from the drawing, the path is too short to expect a sufficient heat blocking between the casings 16 and 26.

Therefore, it is an essential object of the present invention to provide a measure which can solve the above-mentioned problem.

Referring to Fig. 2, there is shown an improved turbocharger 56 according to the present invention. Corresponding parts to those in Fig. 1 are designated by the same numerals. The turbocharger 56 comprises a turbine wheel 12 and a compressor wheel 14 which are separately encased in a turbine wheel casing 16 and a compressor wheel casing 18. The wheels 12 and 14 are mounted on and rotate with a common turbine-shaft 20. A center casing 26 is sealingly disposed between the turbine wheel casing 16 and the compressor wheel casing 18 and supports the turbine-shaft 20 by means of floating bearings 28 and 30. Designated by numeral 58 is a seal supporting casing which is disposed between the center casing 26 and the compressor wheel casing 18 for mounting therein a known seal device 60. The turbine side of the turbocharger 56 mounts to the exhaust manifold outlet flange 22, and the compressor wheel side connects with the air intake manifold 24. Designated by numeral 61 is a ring seal which is mounted in the center casing 26 in the vicinity of the bearing 28. The center casing 26 is formed with a lubricant oil inlet 32, an oil passage 34 and small passages 35 through which a suitable amount of cooling and lubricant oil is supplied to the bearings 28 and 30. As is seen from the drawing, the center casing 26 is formed with an enlarged chamber 62 which extends along a stay portion 64 for the bearings 28 and 30 and extends to a domed wall top portion 66 where the ring seal 60 is positioned. A passage 68 is formed to connect the lubricant oil inlet 32 to the chamber 62, and an oil jet opening 70 is formed in such a manner that the oil in the passage 34 is jetted toward the domed wall top portion 66 of the center casing 26. Although not shown in the drawing, the enlarged chamber 62 has an outlet opening which is exposed to the oil chamber 36 of the center casing 26. By the presence of the enlarged chamber 62 through which the cooling and lubricant oil flows, the stay portion 64 and the domed wall portion 66 of the center casing 26 are cooled under operation of the turbocharger 56.

In the present invention, the following heat blocking measures are employed to minimize the heat transmission from the turbine wheel casing 16 to the center casing 26.

As is understood from the drawing, the center casing 26 has a bell-shaped construction 26a at the turbine side where the ring seal supporting domed wall 66 is defined. The domed portion of the bell-shaped construction 26a is coaxially disposed in a tapered mouth portion 16a of the turbine wheel casing 16. The center casing 26 is formed at the domed portion 26a with axially spaced first and second outward flanges 72 and 74. The tapered mouth portion 16a of the turbine wheel casing 16 is formed at its leading end with an outward flange 76 which is shaped to match in size with the second flange 74 of the center casing 26. Upon coupling between the center casing 26 and the turbine wheel casing 16, the first flange 72 of the center casing 26 is seated, through a heat insulator or gasket 78 and a flange portion of a heat insulating member 54, on a stepped portion 80 formed at the inside surface of the mouth portion 16a of the turbine wheel casing 16, while leaving a certain clearances 81 and 82 between the center casing 26 and the turbine wheel casing 16. The heat insulator 78 may be of a ceramics. By this coupling, an annular chamber 83 is defined between the tapered outside surface of the center casing 26 and the tapered inner surface of the mouth portion 16a of the turbine wheel casing 16, which chamber 83 is merged with the clearance 82. A V-band 84 is tightly mounted on the flanges 74 and 76 to couple these casings 26 and 16, leaving the certain clearance 82 therebetween. The V-band 84 is formed with a plurality of openings 84a to provide a communication between the clearance 82 and thus the annular chamber 83 and the open air. It is to be noted that the portion (which will be referred to as a seating portion hereinafter) where the first flange 72 of the center casing 26 is in contact with the stepped portion 80 of the turbine wheel casing 16 is positioned closer to the turbine wheel casing proper 16 than the portion (which will be referred to as a coupling portion hereinafter) where the second flange 74 of the center casing 26 is substantially secured to the flange 76 of the turbine wheel casing 16. The annular chamber 83 is thus located between the seating portion and the securing portion, as is seen from the drawing.

With the above-stated construction of the present invention, the following advantageous heat flowing manner is expected, which prevents the interior of the center casing 26 and thus the bearings 28 and 30, particularly the bearing 28, from being severely heated.

In the construction of the present invention, the major heat transmitting path from the severely heated turbine wheel casing 16 to the bearing 28 is the shortest path in the solid section of the

center casing 26 which extends from the afore-mentioned seating portion (where the first flange 72 of the center casing 26 is in contact with the stepped portion 80 of the turbine wheel casing 16) to the bearing 28. The heat transmission effected at the seating portion is however effected through the heat insulator 78, so that the heat transmission at that portion is poor. Besides, the first flange 72 and its vicinity of the center casing 26 are cooled by air in the annular chamber 83. The air in the chamber 83 is naturally circulated by convection when the turbocharger is warmed or heated. With these advantageous phenomena, the interior of the center casing 26 and thus the bearings 28 and 30 are prevented from being severely heated even at the time just after stopping of the turbocharger 56. Thus, the afore-mentioned thermal damage of the bearings 28 and 30 and the thermal deterioration of lubricant oil are eliminated or at least lessened.

If desired, the following measure may be employed for much more effectively achieving the heat blocking from the turbine wheel casing 16 to the center casing 26. As is indicated by a phantom line in Fig. 2, a conduit 86 extends from an outlet portion of the compressor wheel casing 18 to the annular chamber 83 defined between center casing 26 and the turbine wheel casing 16. A check valve 88 is disposed in the conduit 86 for checking an air flow in the direction from the annular chamber 83 to the compressor. Under operation of the turbocharger 56, a part of the compressed air produced by the compressor is supplied to the annular chamber 83 through the conduit 86, thereby effectively cooling the center casing 26.

CLAIMS

1. A turbocharger comprising:

a turbine wheel casing having a highly heated portion;

a compressor wheel casing;

a center casing disposed between said turbine wheel casing and said compressor wheel casing and supporting by means of bearings a turbo-shaft which carries a turbine wheel and a compressor wheel which are respectively housed in said turbine wheel casing and said compressor wheel casing;

first means for seating only a first given portion of said center casing on a second given portion of said turbine wheel casing in a manner to define between said turbine wheel casing and said center casing a considerable clearance;

a heat insulating material intimately disposed between said first given portion and said second given portion;

second means for securing said turbine wheel casing and said center casing while keeping said clearance therebetween, said first means being located closer to the highly heated portion of said turbine wheel casing than said second means; and

third means for defining an enlarged continuous chamber between said first and second means, said chamber being merged with said clearance.

2. A turbocharger as claimed in Claim 1, in which said turbine wheel casing has an enlarged tapered mouth portion which extends from the major portion of said turbine wheel casing and terminates at its leading end, and in which said center casing is of a bell-shaped construction, said center casing being coaxially disposed at its domed portion in said enlarged tapered mouth portion of said turbine wheel casing, while leaving said considerable clearance therebetween except at the portion where said first means is positioned.

3. A turbocharger as claimed in Claim 2, in which said center casing is formed with an enlarged chamber which extends along a stay portion for said bearings toward the top of the domed portion of said center casing, said enlarged chamber being supplied with a lubricant oil under operation of said turbocharger for cooling and lubricating the center casing.

4. A turbocharger as claimed in Claim 3, in which said first means comprises:

a first flange integrally formed on the domed portion of said center casing; and

a stepped portion formed on the tapered inner side surface of said enlarged mouth portion of said turbine wheel casing,

whereby, upon coupling of said center casing with said turbine wheel casing, said first flange is seated on said stepped portion through said heat insulating material.

5. A turbocharger as claimed in Claim 4, in which said second means comprises:

a second flange integrally formed on the domed portion of said center casing at a position closer to said compressor wheel casing than said first flange,

a third flange formed on said leading end of the mouth portion of said turbine wheel casing; and

a band tightly mounted on said second and third flanges for securing these second and third flanges in a fixed spaced relationship.

6. A turbocharger as claimed in Claim 5, in which said band is a V-band having a plurality of openings formed therethrough.

7. A turbocharger as claimed in Claim 6, further comprising fourth means which comprises a conduit extending from an outlet portion of said compressor wheel casing to said enlarged continuous chamber of said third means, and a check valve mounted in said conduit to check an air flow in a direction from said chamber toward said compressor.

8. A turbocharger as claimed in Claim 1, further comprising a heat insulating member which is spacedly disposed between the domed top portion of said center casing and the bottom portion of the mouth portion of the turbine wheel casing.

9. A turbocharger as claimed in Claim 8, in

which said heat insulating member extends from said first means to a portion close to said turbo-shaft.

10. A turbocharger substantially as described in the specification with reference to Fig. 2 of the drawings.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1984. Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.